| ERIC Document Resume | See Instruction Sheet | DATE OF RESUME | DATE RECEIVED |
|---|---|---|---|

A. PUBLICATION DATA

| 1. ED NUMBER | 2. ORIGINATOR CONTROL NO(S). | 3. IDENTIFICATION NO. | DO NOT WRITE IN SPACE BELOW |
|---|---|---|---|
| ED001608 | NA | NA | |

4. AUTHOR(S):
Garber, Claire N.

5. TITLE OF DOCUMENT ABSTRACTED:
Great Cities School Improvement Program School District of Philadelphia: Arithmetic Program Fourth Year

6. PUBLICATION TITLE:
NA

7. EDITOR(S):
NA

8. PLACE OF ORIGIN
Great Cities School
ORG. Improvement Program
ST. Philadelphia, Pa.
CITY, STATE

9. PUBLISHER OR SOURCE
Great Cities School Improvement Program
School District of Philadelphia

| 10. VOL. | 11. PAGES | 12. MO./YR. | 13. TOTAL PP. |
|---|---|---|---|
| NA | NA | Aug 64 | 8 |

TELE. EXT.
INST/LOC CODE

MICROFILM COPY AVAILABLE
YES ☒ NO ☐

COPYRIGHT GRANTED
YES ☐ NO ☒

COPYRIGHT RELEASE FILED
YES ☐ NO ☐

TYPE OF REPORT
PROPOSAL ☐
IN-PROGRESS ☐
FINAL ☒
FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR
teacher guide

16. INDEXING TERMS (6-12)

| | | | |
|---|---|---|---|
| algorisms | arithmetic curriculum | integrated structure | |
| quotient | fourth grade | number operations | social settings |
| elementary education | student motivation | Great Cities School Improvement Program | |
| | | Philadelphia, Penn. | |

17. ABSTRACT (MAX. 250 WORDS):

The fourth year should continue the sequential presentation of mathematical understandings and relationships. New Learnings should be presented concretely in social settings within the children's framework of understanding. Graphic materials may be used to bridge the understandings from the concrete to the abstract level.

The number system unit should teach the children to read and write numerals up to five digits. An introduction to Roman numerals should be made.

The study of whole numbers can expand the children's knowledge of addition, subtraction, multiplication, and division. Division should be related to multiplication and to successive subtractions. Algorisms containing intermediate as well as final remainders should be utilized. The children should learn to estimate quotients by using rounded-off numbers.

The study of parts should explore the fraction concept and decimals; the study of measurements, time, linear and quantity, and temperature; the study of graphs and charts, charts, scores and graphs; and the study of geometric concepts, forms and area.

Specific teaching approaches are outlined.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

| 19. SUPPORTING ORGANIZATION | 20. DIVISION OR DEPT. | 21. CONTRACT NO. / PROJECT NO. |
|---|---|---|
| | 22. TOTAL COST OF PROJECT | |
| | 23. DURATION OF PROJECT | U.S. Department of Health, Education, and Welfare Office of Education |

ERIC Form 1

REPRINTED BY PERMISSION
U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN PRINTED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

ED001608

GREAT CITIES SCHOOL IMPROVEMENT PROGRAM
SCHOOL DISTRICT OF PHILADELPHIA

# ARITHMETIC PROGRAM
# FOURTH YEAR

Claire N. Garber
Arithmetic Consultant
August 1964

GREAT CITIES SCHOOL IMPROVEMENT PROGRAM
SCHOOL DISTRICT OF PHILADELPHIA

## FOURTH YEAR

The fourth year continues the sequential presentation of mathematical understandings and relationships. New learnings are presented concretely in social settings within the children's understandings. Graphic materials are used to bridge the understandings from the concrete to the abstract level. The learnings should be enriched to help children to gain greater insights into the integrated structure of arithmetic as well as the operations on number.

I. Number System

A. Reading and writing numerals for numbers to five places.

1. Review understanding of ten as a standard group and its use in related thinking as far as one thousand (ten hundreds).

2. Review understanding that each place or position has ten times the value of the one to the right.

3. Review understanding that each place or position has one tenth the value of the place to the left.

4. Review understanding that our system of numeration uses ten for a base.

5. Develop the understanding of ten thousands; this is also considered as one hundred hundreds, one thousand tens and ten thousand ones.

6. Analyze the composition of groups to ten thousands.

67,534

60 thousands + 7 thousands + 5 hundreds + 3 tens + 4 ones
67 thousands + 5 hundreds + 3 tens + 4 ones
675 hundreds + 3 tens + 4 ones
67,534 ones

and 60,000
7,000
500
30
4
67,534

B. Introduction of Roman Numerals

1. Retell the history of number.

2. Introduce Roman numerals and equate with Hindu-Arabic numerals.

3. Find present uses of Roman numerals.

II. Study of Whole Numbers

A. Addition

1. Check children's understandings of regrouping of ones and tens (carrying).

2. Introduce regrouping of hundreds.

3. Help children to discover that hundreds are added and regrouped like tens and ones.

4. Emphasize the need for writing numerals in their proper columns.

5. Use expanded forms at the learning level.

$$\begin{array}{r} 346 = 3 \text{ hundreds} + 4 \text{ tens} + 6 \text{ ones} \\ \underline{234 = 2 \text{ hundreds} + 3 \text{ tens} + 4 \text{ ones}} \\ 5 \text{ hundreds} + 7 \text{ tens} + 10 \text{ ones} = \\ 5 \text{ hundreds} + 8 \text{ tens} + 0 \text{ ones} = 580 \end{array}$$

6. Extend column addition to three addends.

7. Introduce addition with four place numerals (thousands).

8. Use decimal form of U. S. money in addition.

9. Guide children to discover several ways of checking answers.

10. Help children to discover the commutative property of addition. The children need not label the operation but should arrive at the generalization that the position of the addends does not affect the sum.

B. Subtraction

1. Check children's understanding of regrouping (borrowing) of tens and ones.

2. Introduce concretely regrouping in the hundreds.

3. Help the children to discover that hundreds are subtracted and regrouped like tens and ones.

4. Emphasize the need for writing numerals in their proper column.

5. Use expanded form at the learning level.

583 = 5 hundreds + 8 tens + 3 ones
-194 = 1 hundred + 9 tens + 4 ones

5 hundreds + 7 tens +13 ones
-1 hundred + 9 tens + 4 ones
9 ones

4 hundreds +17 tens +13 ones
-1 hundred + 9 tens + 4 ones
3 hundreds + 8 tens + 9 ones = 389

6. Guide the children to discover that thousands are subtracted and regrouped like hundreds, tens, and ones.

7. Use the decimal form of U. S. money for subtraction.

8. Help the children to discover that subtraction is the inverse operation of addition; therefore, addition may be used to check subtraction.

C. Multiplication

1. Check children's understanding of multiplication.

Factors { 9 multiplicant - size of each set or group.
X6 multiplier - number of sets or groups.
54 product

6 multiplier X 9 multiplicant = 54 product

2. Relate multiplication to addition

96 × 4 = 96 + 96 + 96 + 96

3. Check children's understanding of multiplication of tens and ones.

4. Help children to discover that hundreds are multiplied like tens and ones.

5. Use the expanded form at the learning level.

854 × 8 = 800 × 8 + 50 × 8 + 4 × 8 = 6400 + 400 + 32 = 6832

or

8 hundreds + 5 tens + 4 ones
x 8
64 hundreds +40 tens +32 ones =
64 hundreds +43 tens + 2 ones =
68 hundreds + 3 tens + 2 ones = 6,832

6. Extend the learnings to multiplying thousands (multiplicand)

7. Extend multiplication learnings to a two place multiplier, multiplying tens by tens.

$$\begin{array}{r} 56 \\ \times 27 \\ \hline \end{array} = \begin{array}{r} 56 \\ \times 20 \\ \hline 1120 \end{array} + \begin{array}{r} 56 \\ \times\ 7 \\ \hline 392 \end{array} = \begin{array}{r} 1120 \\ 392 \\ \hline 1512 \end{array}$$

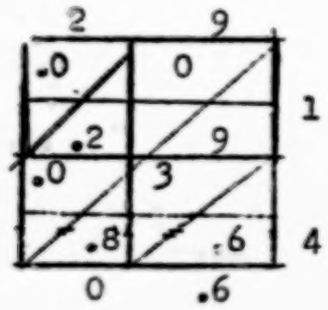
most efficient algorism

$$\begin{array}{r} 56 \\ \times 27 \\ \hline 392 \\ 1120 \\ \hline 1512 \end{array} \qquad \begin{array}{r} 56 \\ \times 27 \\ \hline 392 \\ 112 \\ \hline 1512 \end{array}$$

8. Encourage the children to check results in various ways.

9. Enrich the multiplication concepts by lattice multiplication, scratch method, cross number puzzles, etc.

Example




= 406

Check

$$\begin{array}{r} 29 \\ \times 14 \\ \hline 116 \\ 29 \\ \hline 406 \end{array}$$

D. Division

1. Check children's understanding of the two ideas in division:

The containing idea - dividing to find the number of equal groups in a given amount.

size of each group ) number of equal groups / total amount

The partitioning idea - dividing to find the size of each group in a given amount

number of equal groups ) size of each group / total amount

2. Relate division to multiplication: finding the missing factor.

$$\begin{array}{r} \square \\ \times 5 \\ \hline 35 \end{array} \text{ factors} \qquad 5\overline{)35}\ \square \qquad \begin{array}{r} 7 \\ \times\ \square \\ \hline 35 \end{array} \qquad 7\overline{)35}\ \square$$

3. Relate division to successive subtractions.

$$4\overline{)12}\ 3$$

$$\begin{array}{r} 12 \\ -\ 4 \\ \hline 8 \\ -\ 4 \\ \hline 4 \\ -\ 4 \\ \hline 0 \end{array} \begin{array}{l} \ldots\ldots 1 \\ \ldots\ldots 1 \\ \ldots\ldots 1 \\ 3 \text{ fours} \end{array}$$

$$3\overline{)369}\ \begin{array}{r} -300 \\ \hline 69 \\ -60 \\ \hline 9 \\ -\ 9 \\ \hline \end{array} \begin{array}{l} 100 \\ 20 \\ 3 \\ 123 \end{array}$$

4. Guide the children to arrive at the generalization that hundreds are divided like tens and ones, and that thousands are divided like hundreds, tens and ones. Stress the significance of place value and position.

5. Use the expanded form to further understanding.

| | quotient | | | | |
|---|---|---|---|---|---|
| $4\overline{)\ 8484}$ | $4\overline{)\ 8000}$ | $4\overline{)\ 400}$ | $4\overline{)\ 80}$ | $4\overline{)\ 4}$ | = 2000 addition of |
| | 2000 | 100 | 20 | 1 | 100 quotients |
| | | | | | 20 |
| | | | | | 1 |
| | | | | | 2121 |

Another form

1 ⟩ quotients
20 ⟩
100 ⟩
2000 ⟩ = 2121

$4\overline{)\ 8484}$
8000
484
400
84
80
4
4

The most efficient algorism is the most abstract; therefore, it is the most difficult.

$4\overline{)\ 8484}$ 2121
8
4
4
8
8
4
4

6. Utilize algorisms containing intermediate as well as final remainders.

$6\overline{)\ 1944}$ 324
18
intermediate remainders ( ..... .14
12
( ..... .24

$7\overline{)\$3.95}$ .56
35
45
42
3 final remainder

7. Use the decimal form of U. S. money in division.

8. Help children to estimate quotients by using rounded off numbers.

9. Help children to discover various ways of checking results.

III. Study of Parts

A. Fraction Concept

1. Use manipulative materials to develop the concept of a fraction.

2. Check the children's thinking through oral discussions.

3. Guide the children to discover that a fraction is one or more of the equal parts of a unit.

4. Establish the concepts of numerator and denominator before using the terms.

5. Guide the children to recognize differences in the sizes of parts.

For example:

Superimpose a fractional part such as $\frac{1}{3}$ of a square or circle on $\frac{1}{2}$ of the same unit. Let the children find which is the larger and which is the smaller fraction. Repeat this with many fractional parts.

6. Compare fractional parts of units of different sizes to find that all halves, quarters, thirds, etc. are not necessarily identical in size or shape.

For example: $\frac{1}{3}$ inch, $\frac{1}{3}$ desk

7. Help the children to discover the relationship between parts.

For example: A part may be divided into smaller equal parts.

$$\frac{1}{2} = \frac{2}{4} \qquad \frac{1}{3} = \frac{2}{6}$$

Smaller parts may be combined to make a larger part.

$$\frac{2}{4} = \frac{1}{2} \qquad \frac{2}{6} = \frac{1}{2}$$

8. Have the children discover that exact comparisons can be made when all the parts come from the same size units.

Note: This understanding is necessary when adding or subtracting fractions.

For example: To compare $\frac{1}{4}$ and $\frac{1}{8}$ exactly, we change $\frac{1}{4}$ to $\frac{2}{8}$

9. Use fractions in linear, quantity, and time measurements.

B. Decimals

Use decimal form of U. S. money in all four operations.

IV. Measurements

A. Time

1. Review telling time to hour, half hour, quarter hour, and five minutes.

2. Develop telling time to the minute.

3. Read time tables.

4. Develop the significance of B.C. and A.D.

5. Study time zones in the world and develop tables of time equivalents.

6. Develop the idea of a century.

B. Linear and quantity

1. Introduce measuring instruments

2. Organize tables of weights and measures

C. Temperature

1. Introduce the concept of plus and minus numbers.

2. Read degrees (°)noting freezing point of water 32°F and boiling point of water 212°F.

3. Note normal body and room temperatures.

4. Compare seasonal temperatures.

5. Correlate with other areas of the curriculum.

V. Graphs and Charts

A. Charts

1. Use weather, population, attendance, tests, etc.

2. Correlate with other areas of the curriculum.

B. Scores

1. Find averages, medians, etc.

2. Correlate with other areas of the curriculum.

C. Graphs

1. Develop and interpret pictographs, circle, bar and line graphs.

2. Correlate with other areas of the curriculum.

VI. Geometric Concepts

A. Forms

1. Help the children to recognize geometric forms including cube, sphere, and hemisphere.

2. Help children to reproduce and construct geometric forms.

B. Area

1. Develop the idea of square measure.

2. Use square measures in inch, foot and yard.